

AmendmentsIN THE CLAIMS:

Please amend the pending claims as indicated in the following complete listing:

Claims 1-10 (previously canceled).

11. (Original) A control system for controlling a plurality of numerically controlled machine tools capable of selectively performing similar or different machining operations on parts delivered to said machine tools, which parts may be the same or different and each of which has a process indicia associated therewith, comprising:

storage means for storing parts;

delivery means, having access to each of the parts in said storage means and to each of said machine tools, for delivering a selected part between said storage means and selected of the machine tools;

central computer means comprising a plurality of programs for controlling machining operations at all of the machine tools;

control means responsive to any one of said process indicia for coupling to any one of said machine tools the program from said central computer means which controls the machining operation to be performed on a part delivered to said one machine tool and which part is identified by the process indicia associated therewith;

part identification means for identifying the process indicia of a part, including a record medium carried along with said part and forming said process indicia, and a read unit associated with at least one machine tool and responsive to the record medium for identifying said process indicia represented thereby;

said control means including at least one data link connected between said central computer means and each of said machine tools for coupling

programs to the machine tools associated therewith, and means for connecting the program identified by the process indicia to the data link for the machine tool at which the part is located.

12. (Original) A control system for controlling a plurality of numerically controlled machine tools capable of selectively performing similar or different machining operations on parts delivered to said machine tools, which parts may be the same or different and each of which has a process indicia associated therewith, comprising:

storage means for storing parts;

delivery means for having access to each of the parts in said storage means and each of said machine tools, for delivering a selected part between said storage means and selected of the machine tools;

central computer means comprising a plurality of programs for controlling machining operations at all of the machine tools;

data link means coupling said computer means to each of said machine tools to transmit a program from said computer means to any one of said machine tools; and

control means responsive to any one of said process indicia for coupling to any one of said machine tools the program from said central computer means which controls the machining operation to be performed on a part delivered to said one machine tool and which part is identified by the process indicia associated therewith.

13. (Previously amended) A control system for controlling a plurality of numerically controlled machine tools, some of which are capable of performing similar machining operations on a part, comprising:

central computer means having a memory for storing a plurality of different programs, each program providing information for controlling more

than one of said plurality of machine tools to produce the same series of machining operations on a part;

a plurality of data link means coupling said computer means to each of said plurality of machine tools in order to transmit a program stored in said memory to any one of said plurality of machine tools;

a central supply of parts on which similar and different series of machining operations are to be performed by any one of said plurality of machine tools;

means responsive to the conveyance of said part for generating a signal which identifies the series of machining operations which are to be performed on said conveyed part;

means for selecting the program stored in said memory which controls the same series of machining operations as identified by the signal generating means and for transmitting said last named program over the data link connected to the machine tool to which said part has been conveyed.

14. (Original) A machine tool installations for machining workpieces comprising:

(a) a plurality of complementary numerically controlled machine tools,

(b) a source of workpieces,

(c) transport means to transport a selected workpiece between said source and said machine tools along a path between said source and each of the machine tools, and

(d) central programmed control means and data link means coupling said control means to each of said machine tools and to said transport means to control said transport means and to transmit a program from said control means to any one of said machine tools to control each of said machine tools so that

each machine tool to which a workpiece is delivered by said transport means performs on said workpiece at least one predetermined machining operation.

15. (Original) A machine tool installation comprising

a plurality of complementary numerically controlled machine tools located adjacent a predetermine path,

a source of workpieces for said machine tools, said source being located along said path,

conveyor means to convey a selected workpiece along said path between the source and the machine tools from which there is access for workpieces to the plurality of machine tools so that each workpiece can be taken to a selection of machine tools appropriate to the machining operations to be performed thereon,

a plurality of cutting tools for the machine tools, and

central control means including

a plurality of programs for programming the machine tools to perform appropriate machining operations and

means connecting said control means to said conveyor means and each of said machine tools to control the conveying operations carried out by the conveyor means to supply appropriate workpieces to the machine tools and to supply appropriate programs to the machine tools and to control the selection by the machine tools of appropriate cutting tools.

16. (Original) A machine tool installation for machining workpieces comprising:

(a) a plurality of complementary numerically controlled machine tools,

(b) at least one transfer station including means for supporting workpieces,

(c) means defining a path extending between said transfer station and each of said machine tools,

(d) storage means located along said path between said transfer station and said plurality of machine tools and adapted for storage of workpieces,

(e) transport means for transporting a selected workpiece along said path between said transfer station, said storage means and each of said machine tools, and

(f) central programmed control means and means connecting said control means to said transport means and to each of said machine tools to control said transport means to convey said workpiece between said transfer station and said storage means and selected workpieces between said storage means and selected of said machine tools and to control each of said machine tools so that each machine tool to which a workpiece is delivered by said transport means performs on said workpiece at least one predetermined machining operation.

17. (Original) A machine tool installation for machining workpieces comprising:

(a) a plurality of complementary numerically controlled machine tools,

(b) means for transferring workpieces to and from said machine tool installation at at least one transfer station,

(c) transport means for transporting workpieces between said transfer station and each of said machine tools,

(d) said transport means including at least one storage section, there being access to each workpiece in said storage section and to each machine tool, for receiving, storing and dispensing workpieces, and

(e) programmed control means and means connecting said control means to said transport means and to each of said machine tools to control said transport means to convey from said storage section a selected one of said workpieces to and from selected of said machine tools and to control each of said machine tools so that each machine tool to which a workpiece is delivered by said transport means performs on said workpiece at least one predetermined machining operation.

18. (Original) A manufacturing system, comprising:

(a) a plurality of numerically controlled machine tools for machining a plurality of workpieces,

(b) storage means for storing said workpieces,

(c) distinguishing identification means associated with each of said workpieces,

(d) a conveyor extending along a path between the machine tools and storage means for conveying workpieces between said storage means and said machine tools and for presenting a workpiece selected from said storage means to the machine tools and including means at key points along said path for sensing said identification means and generating identification signals,

(e) a computer having a memory and means connecting said computer to each of said machine tools,

(f) means responsive to said identification signals for transferring to the memory of said computer instructions relating to a particular workpiece as it enters the conveyor for movement from one of said machine tools to another, and

(g) means responsive to said identification signals and associated with said computer to send instructions to a particular machine tool when the particular workpiece arrives at that particular machine tool.

19. (Original) A machine tool installation for machining workpieces of different types requiring different machining operations and comprising:

- (a) a plurality of complementary numerically controlled machine tools located adjacent a predetermined path;
- (b) storage means located adjacent said path and adapted for storing a plurality of selectively accessible workpieces;
- (c) transport means operable to transport selected of said workpieces independently of other workpieces between said storage means and said machine tools along said path from which there is access to said selectively accessible workpieces in the storage means and each of the machine tools; and
- (d) central programmed control means and means connecting said central programmed control means with each of said numerically controlled machine tools and said transport means to control movement along said path of selected of said workpieces by said transport means between at least one of said machine tools and said storage means and to control movement of each workpiece between said storage means and a predetermined selection of the machine tools.

20. (Original) A control system for controlling a plurality of numerically controlled machine tools capable of selectively performing similar of different machining operations on parts delivered to said machine tools, which parts may be the same or different and each of which has process indicia associated therewith, comprising:

storage means adapted for storing a plurality of selectively accessible parts while they are not being machined;

means for delivering selected of said parts from said storage means to selected of said machine tools;

central computer means comprising a plurality of programs for controlling machining operations at all of the machine tools;

control means responsive to any one of said process indicia for coupling to any one of said machine tools the program from said central computer means which controls the machining operation to be performed on a selected part delivered to said one machine tool and which selected part is identified by the process indicia associated therewith;

part identification means for identifying the process indicia of a part, including a record medium carried along with said part and forming said process indicia, and a read unit associated with at least one machine tool and responsive to the record medium for identifying said process indicia represented thereby;

said control means including at least one data link connected between said central computer means and each of said machine tools for coupling programs to the machine tools associated therewith, and means for connecting the program identified by the process indicia to the data link for the machine tool at which the selected part is located.

21. (Original) A control system for controlling a plurality of numerically controlled machine tools capable of selectively performing similar or different machining operations on parts delivered to said machine tools, which parts may be the same or different and each of which has a process indicia associated therewith, comprising:

storage means adapted for storing a plurality of selectively accessible parts while they are not being machined;

means for delivering selected of said parts from said storage means to selected of said machine tools;

central computer means comprising a plurality of programs for controlling machining operations at all of the machine tools;

data link means coupling said computer means to each of said machine tools to transmit a program from said computer means to any one of said machine tools; and

control means responsive to any one of said process indicia for coupling to any one of said machine tools the program from said central computer means which controls the machining operation to be performed on a selected part delivered to said one machine tool and which selected part is identified by the process indicia associated therewith.

22. (Original) A control system for controlling a plurality of numerically controlled machine tools, some of which are capable of performing similar machining operations on a part, comprising:

central computer means having a memory for storing a plurality of different programs, each program providing information for controlling more than one of said plurality of machine tools to produce the same series of machining operations on a part;

a plurality of data link means coupling said computer means to each of said plurality of machine tools in order to transmit a program stored in said memory to any one of said plurality of machine tools;

a central supply adapted for storing a plurality of selectively accessible parts on which similar and different series of machining operations are to be performed by any one of said plurality of machine tools;

means for conveying a selected part from said central supply to one of said plurality of machine tools;

means responsive to the conveyance of said selected part for generating a signal which identifies the series of machining operations which are to be performed on said conveyed part;

means for selecting the program stored in said memory which controls the same series of machining operations as identified by the signal from said generating means and for transmitting said last name program over the data link connected to the machine tool to which said selected part has been conveyed.

23. (Original) A machine tool installation for machining workpieces comprising:

(a) a plurality of complementary numerically controlled machine tools located adjacent a predetermined path,

(b) storage means located adjacent said path and adapted for storing a plurality of selectively accessible workpieces,

(c) transport means for transporting selected workpieces between said storage means and said machine tools along said path from which there is access to said selectively accessible workpieces in the storage means and each of the machine tools and operable to convey selected workpieces independently of other workpieces, and

(d) central programmed control means and data link means coupling said control means to each of said machine tools to transmit a program from said control means to any one of said machine tools to control each of said machine tools so that each machine tool to which a selected workpiece is delivered by said transport means performs on said selected workpiece at least one predetermined machining operation.

24. (Original) A machine tool installation for machining workpieces comprising:

- (a) a plurality of complementary numerically controlled machine tools,
- (b) a source of workpieces adapted for storing a plurality of selectively accessible workpieces,
- (c) transport means to transport selected workpieces between said source and machine tools along a path from said source to each of said machine tools, and
- (d) central programmed control means and data link means coupling said control means to said transport means and to each of said machine tools to control movement by said transport means along said path of selected of said workpieces between said source and at least one of said machine tools and to control each of said machine tools so that each machine tool to which a workpiece is delivered by said transport means performs on said workpiece at least one predetermined machining operation.

25. (Original) A machine tool installation for machining workpieces comprising:

- (a) a plurality of complementary numerically controlled machine tools,
- (b) a source of workpieces adapted for storing a plurality of selectively accessible workpieces,
- (c) transport means to transport selected workpieces between said source and said machine tools along a path from said source to each of the machine tools, and
- (d) central programmed control means and data link means coupling said control means to each of said machine tools and to said transport means to control said transport means and to transmit a program from said control means to any one of said machine tools to control each of said machine tools so that

each machine tool to which a selected workpiece is delivered by said transport means performs on said selected workpiece at least one predetermined machining operation.

26. (Presently Amended) A machine tool installation for machining workpieces comprising:

- (a) a plurality of complementary numerically controlled machine tools,
- (b) means for transferring workpieces to and from said machine tool installation at at least one transfer station,
- (c) transport means for transporting workpieces between said transfer station and each of said machine tools,
- (d) said transport means including at least one storage section adapted for holding a plurality of selectively accessible workpieces and for selectively receiving, storing and dispensing each of said selectively accessible workpieces, and
- (e) programmed control means and means connecting said control means to said transport means and to each of said machine tools to control said transport means to convey said workpieces selectively to and from selected of said machine tools and to control each of said machine tools so that each machine tool to which a selected workpiece is delivered by said transport means performs a predetermined machining operation.

27. (Original) A manufacturing system, comprising:

- (a) a plurality of numerically controlled machine tools for machining a plurality of workpieces,
- (b) storage means adapted for storing a plurality of selectively accessible workpieces,

(c) distinguishing identification means associated with each of said workpieces,

(d) a conveyor extending along a path between said storage means and the machine tools for presenting workpieces selected from said storage means to the machine tools and including means at key points along said path for sensing said identification means and generating identification signals,

(e) a computer having a memory and means connecting said computer to each of said machine tools,

(f) means responsive to said identification signals for transferring to the memory of said computer instructions relating to a particular selected workpiece as it enters the conveyor for movement from one of said machine tools to another, and

(g) means responsive to said identification signals and associated with said computer to send instructions to a particular machine tool when the particular selected workpiece arrives at that particular machine tool.

28. (Original) A manufacturing system, comprising:

(a) a plurality of numerically controlled machine tools,

(b) storage means adapted for storing a plurality of selectively accessible workpieces,

(c) a conveyor extending between said storage means and each of the machine tools for presenting workpieces selected from said storage means to the machine tools,

(d) pallets for carrying selected workpieces and selectively movable along the conveyor from said storage means to said machine tools and from one machine tool to another,

(e) distinguishing identification means associated with each pallet,

(f) identification stations at key points along the conveyor, each station including means for reading the said identification means and generating an identification signal,

(g) a ready-access memory bank connected to each of the machine tools, and

(h) central programmed control means and means connecting said central programmed control means with each of said machine tools and with said conveyor, said central programmed control means including means responsive to an identification signal for transferring to the ready-access memory bank instructions relating to a particular workpiece as it enters the conveyor for movement from one machine tool to another and means responsive to an identification signal for transmitting instructions from said ready-access memory bank to a particular machine tool when the particular selected workpiece arrives at that particular tool.

Claims 29-79 (canceled).

Claim 80 (Presently added) A tool installation comprising:

- (a) a plurality of complementary numerically controlled tools;
- (b) at least one station where workpieces can be transferred to and from said tool installation;
- (c) a transporter that can transport workpieces between said station and each of said tools;
- (d) said transporter including at least one storage section, there being access to each workpiece in said storage section and to each tool, for receiving, storing, and dispensing workpieces; and
- (e) a controller connected to said transporter and to each of said tools, programmed to control said transporter to convey from said storage section a selected one of said workpieces to and from selected of said tools and to control

each of said tools so that each tool to which a workpiece is delivered by said transporter performs on said workpiece at least one predetermined tool operation.

81. (Presently added) A tool installation for working on workpieces of different types requiring different tool operations and comprising:

(a) a plurality of complementary numerically controlled tools located adjacent a predetermined path;

(b) a storage located adjacent said path from which a plurality of selectively accessible workpieces can be accessed;

(c) a transporter operable to access selected of said workpieces, independently of other workpieces, and transport said accessed workpieces between said storage and said tools along said path; and

(d) a central controller, connected with each of said numerically controlled machine tools and said transporter, and programmed to control movement along said path of selected of said workpieces by said transporter between at least one of said tools and said storage and to control movement of each workpiece between said storage and a predetermined selection of the tools.

82. (Presently added) A control system for controlling a plurality of numerically controlled tools capable of selectively performing similar of different operations on parts delivered to said tools, which parts may be the same or different and each of which has process indicia associated therewith, comprising:

(a) a storage adapted for storing a plurality of selectively accessible parts while they are not being operated on;

(b) a transfer system arranged to deliver selected of said parts from said storage to selected of said tools;

(c) a central computer comprising a plurality of programs for controlling operations at all of the tools;

(d) a controller responsive to any one of said process indicia for coupling to any one of said tools the program from said central computer, which controls the operation to be performed on a selected part identified by the associated process indicia that is delivered to said one tool;

(e) a part identification system for identifying the process indicia of a part, including:

(i) a record medium carried along with said part and forming said process indicia; and

(ii) a read unit associated with at least one tool and responsive to the record medium capable of identifying said process indicia represented thereby;

(f) at least one data link connected between said central computer and each of said tools, for coupling programs to the tools; and

(g) a program selector connecting the program identified by the process indicia to the data link for the tool at which the selected part is located.

83. (Presently added) A control system for controlling a plurality of numerically controlled tools capable of selectively performing similar or different operations on parts delivered to said tools, which parts may be the same or different and each of which has a process indicia associated therewith, comprising:

(a) a storage adapted for storing a plurality of selectively accessible parts while they are not being operated on;

(b) a transfer system arranged to deliver selected of said parts from said storage to selected of said tools;

(c) a central computer comprising a plurality of programs for controlling operations at all of the tools;

(d) a data link coupling said computer to each of said tools to transmit a program from said computer to any one of said tools; and

(e) a controller responsive to any one of said process indicia for coupling to any one of said tools the program from said central computer, which controls the operation to be performed on a selected part delivered to said one tool, which selected part is identified by the associated process indicia.

84. (Presently added) A tool installation comprising:

(a) a plurality of complementary numerically controlled tools located adjacent a predetermined path;

(b) a storage located adjacent said path and adapted for storing a plurality of selectively accessible workpieces;

(c) a transport system operable to selectively access workpieces in the storage independently of other workpieces and convey selected workpieces between said storage and each of said tools along said path; and

(d) central programmed controller coupled through a data link to each of said tools to transmit a program from said controller to any one of said tools to control each of said tools so that each tool to which a selected workpiece is delivered by said transport system performs on said selected workpiece at least one predetermined operation.